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THE EFFECTS OF THE COLD WINTER OF 1933-34 ON THE ORIENTAL FRUIT MOTH

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The winter of 1933-34 was the coldest to which the oriental fruit moth has been exposed in Canada since its discovery in the Niagara peninsula in 1925, and we were naturally very interested to see how it survived. Unfortunately we have to report that it survived very well indeed, although we are glad to say its larval parasites, both native and imported, also survived.

The winters in the Niagara Peninsula are usually comparatively mild. For the period between the discovery of the fruit moth in 1925, to December 1933, the minimum temperature at Vineland Station was -7°F . (January 16, 1927) and sub-zero temperatures occurred on only four days during that period. In comparison, the winter of 1933-34 was much colder, with sub-zero temperatures at Vineland Station on twelve days, and with a minimum temperature of -14°F . It was the coldest winter since 1917-18, when there were seventeen days with sub-zero temperatures and a minimum of -16°F . The following tables give the minimum temperatures from four points in the Niagara peninsula, and the monthly means for Vineland Station. These are official records taken four feet above the ground in standard weather shelters. The lowest temperatures were experienced at the westerly end of the peninsula but unfortunately no official records are available west of Grimsby. The records listed from the Rock Chapel station at Grimsby are from the top of the escarpment and not in the peach area, but are quite probably similar to those experienced near Stoney Creek and Bartonville.

Table No. 1

MINIMUM TEMPERATURES IN THE NIAGARA PENINSULA.

1933-34

Date	Minimum Temperatures in Degrees F.			
	St. Catharines	Vineland Sta..	Grimsby	Grimsby (Rock Chapel)
Dec. 27/33	*	*	0	-1.0
" 28	*	*	*	-1.0
" 29	-4.0	-4.0	-7.0	-11.0
" 30	-3.0	-2.0	-7.0	-11.0
Jan. 29/34	-0.5	-0.5	-3.0	no record
Feb. 6	-1.6	*	-1.0	-2.0
" 7	*	*	*	-1.0
" 8	-8.5	-9.3	-13.0	-14.0
" 9	-8.5	-8.5	-13.0	-18.0
" 10	-12.0	-14.0	-17.0	-20.0
" 14	-0.2	*	-3.0	-7.0
" 15	*	*	*	-4.0
" 17	-9.8	-7.6	-6.0	-2.0
" 20	-0.5	-9.1	-11.0	-11.0
" 21	-3.6	-1.2	*	-10.0
" 23	*	*	*	-1.0
" 24	-4.5	-4.8	-6.0	-10.0
" 25	-3.0	-1.0	-6.0	-8.0
" 27	*	-1.6	-2.0	-5.0
" 28	-1.2	*	-1.0	-7.0

*—Temperature above 0°F .

Table No. 2

MEAN MONTHLY TEMPERATURES AT VINELAND STATION.

Month	1933-34		
	1933-34	Normal (17yr. period)	Difference
December	27.2	29.0	-1.8
January	28.6	24.0	+4.6
February	13.3	25.0	-11.7

We checked the survival of the fruit moth in three ways,—(1) by emergence records from material which overwintered in the field, (2) by determining the presence of spring brood moths in several orchards by using bait traps, and (3) by the size of the first generation in young orchards in comparison with other seasons.

Emergence from field material: Definite numbers of larvae were placed, in the falls of 1932 and 1933, on soil debris, peach stumps, and short sections of peach limbs. The percentage mortality was as follows:—

	1933	1934
on soil debris	95.0	91.4
on stumps	93.9	98.4
on limb sections	52.7	97.2

These figures, which are the average for about 3500 larvae both years, show that there was a considerably higher mortality in 1934 among the larvae on the small sections of peach limbs, but we believe this was partly caused by rodents entering the cover cage and destroying many of the spun up larvae. The mortality on the soil was actually lower in 1934, while that on the stumps was only slightly higher. We also had several thousand larvae spun up in corrugated paper in an open insectary, and their emergence appeared no lower than usual, although we have no definite records of numbers.

Presence of Spring brood moths: Bait traps for population studies were regularly used in four orchards at St. Davids, Niagara-on-the-Lake, Vineland Station, and Grimsby. In addition to these, we placed pails in an orchard at Stamford and in another between Bartonville and Stoney Creek, because lower temperatures were recorded at these two points. Moths were taken in May at all six points showing that the species survived over the whole district. It is interesting to note that at Bartonville there was 100 per cent kill of the peach fruit buds and nearly a complete kill at Stamford.

Table No. 3

RELATIVE SIZE OF SPRING BROODS, 1933 AND 1934.

Owner and location	No. of moths in pails		Difference in 1934
	1933	1934	
Cropp, St. Davids	125	70	-55
Onslow, Niagara-on-the-Lake	280	112	-178
Culp, Vineland Station	132	152	+20
Fleming, Grimsby	194	282	+88
Total	731	616	-115

The relative size of the spring brood, in comparison with that of other seasons, showed little or no reduction due to low temperatures. As can be seen in the above table, there was a comparatively larger spring brood in the two

westerly, colder orchards than in the other two. The reductions at St. Davids and Niagara-on-the-Lake were quite probably caused by parasites rather than low temperatures.

Relative size of first generation in 1933 and 1934: The average twig injury (first generation) over the whole district was 10.2 per cent in 1934, as compared to 9.2 per cent in 1933,—i.e. there was an actual increase following the cold winter. These records were taken in forty-five orchards from the Niagara river west to Bartonville and none of the individual records shows any marked reduction which could be attributed to low temperatures. It should be pointed out here that the size of the overwintering population was approximately the same for both seasons, the average Elberta fruit injury at picking time being 12.9 per cent in 1932, and 10.5 per cent in 1933. The corresponding Elberta injury in 1934 was 7.6 per cent.

Table No. 4.

SUMMARY OF TWIG INJURY RECORDS, 1933 AND 1934.

Number and Location	% Twig Injury		Difference in 1934
	1933	1934	
18 orchards, Queenstown to St. Catharines	7.5	9.3	+1.8
9 orchards, St. Catharines to Grimsby Beach	6.1	8.4	+2.3
10 orchards, Grimsby Beach to Bartonville	12.34	11.90	-0.4
Average, whole district	9.2	10.2	+1.0

Another point which interested us was what effect the light crop would have on the fruit moth population. The Elberta crop over the whole district was on the average approximately one-third that of the average for the previous three seasons. Some other varieties, notably the Rochester, stood the winter much better. The peach crop was almost normal at the east end of the peninsula below the escarpment, whereas it continued to decrease from St. Catharines west to Bartonville. There was no crop at all at the latter point and a very light one for the area west of Grimsby.

Table No. 5

RELATIVE SIZE OF ELBERTA CROP FOR PAST FOUR SEASONS.

Owner and Location—	Average No. peaches per tree			
	1931	1932	1933	1934
Fisher, Queenstown	965	916	778	602
Onslow, Niagara-on-the-Lake	1324	649	212	223
Cropp, St. Davids	598	378	419	196
Culp, Vineland Station	777	1057	867	320
Fleming, Grimsby	932	675	753	149
Peace, Bartonville	600*	574	653	0
Total	5196	4249	3682	1490
Average	866	708	613	248

*—Estimated.

We were afraid that there might be a migration from the no crop area, after the twigs hardened, to nearby apple orchards. However, apparently there was no appreciable migration, as very few moths were taken in bait pails, and no larvae found in the fruit, in an apple orchard at Bartonville adjoining a "no-crop" peach orchard, in which weekly pail catches indicated a fair sized fruit moth

population. The probabilities therefore are that most of the second generation moths laid their eggs in the peach orchards, and that comparatively few of the resulting larvae would mature in the few twigs succulent enough at this season to support them. In view of this we anticipate a reduction in the moth population next spring in the orchards that had no crop.

NOTES ON EARLY STAGES OF CERTAIN CANADIAN MICROLEPIDOPTERA*

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In the months of June and July field work was carried on by myself in western Nova Scotia at the following localities—Annapolis Royal in the Annapolis Valley, South Milford in the interior and White Point Beach on the south shore near Liverpool. A number of life histories of various Microlepidoptera were worked out and data on the early stages secured. I offer the following notes on several of these species concerning which, as far as I know, our knowledge is very fragmentary. As in a previous work of this nature (1933, Can. Jour. Res. IX, 502-517) I have checked as far as possible both Fracker's larval classification (1915, Ill. Biol. Mon. II) and Mosher's work on the pupae (1916, Bull. Ill. Sta. Lab. Nat. Hist. XII, Art. 2).

PYRAUSTINAE.

Phlyctaenia itysalis Wlk.

A good series was bred at White Point Beach from larvae feeding on *Mertensia maritima* (Lungwort), the adults emerging in early August. The larva is quite sluggish and rests either between two leaves, lightly sewn together, or on the underside of the larger leaves which lie more or less flat on the sand. The synonymy of the species has been recently dealt with by Curtis (1934, Ent. Rec. XLVI, 37) and there seems no doubt that at least the name *hyperborealis* Moesch., placed as a synonym, will apply to the present series. Breeding records from western provinces are much to be desired.

Larva: Pale greenish-white, rather moist and shiny-looking; head pale, the lateral lobes marbled with light brown, the labrum shaded with blackish; a small black spot in postero-lateral region of each lobe; ocelli arranged in a regular arc and setal arrangement much as in Heinrich's figure of *Pyrausta nubilalis* Hbn. (1919, Jour. Agr. Res. XVIII, Pl. X, B). Prothoracic shield pale, with a median ring of minute dark dots including the *beta* seta and a small lateral dark dash; setae arising from small, black bases. Anal shield pale, hemispherical, slightly pitted with minute dark dots; the setae with dark bases as on prothoracic shield. Abdominal setae pale brownish with small black bases situated on large pinacula of a color scarcely deeper than the light ground-color except on anterior segments where they are partially brown-tinted. Spiracles small (except on eighth abdominal) pale, circular, finely ringed with black. Legs pale; prolegs with crotchets triordinally arranged in a mesal penellipse (Fracker, fig. 98).

The setal arrangement is typically Pyralid according to Fracker's keys, having the *Kappa* group on the prothorax bisetose; it will also trace down in the same keys to the subfamily Pyraustinae, (*op. cit.* p. 87) with the *Pi* group on

*Contribution from the Division of Systematic Entomology, Entomological Branch, Department of Agriculture, Ottawa.

meso- and metathorax unisetose and *kappa* and *mu* absent on segment 9. On the prothorax *alpha* and *gamma* are situated, well apart, on the anterior edge of the shield with *epsilon* much closer to *gamma* than is *alpha* and somewhat caudad of same, the *gamma* seta being longer than the others; *beta* is smaller than the rest and occupies the median area of the shield close to mid-dorsal line whilst *delta* and *rho* are in line, well-removed from posterior margin of shield, *delta* being about halfway between *rho* and the median line; both *epsilon* and *rho* are placed close to lateral edge of the shield. *Kappa* and *eta* are situated close together on a large oblong pinaculum anterior to the spiracle, the former about half the length of *eta*. The two setae of the *Pi* group are well separated and situated on the anterior half of a large pinaculum which occupies nearly the whole length of the segment. On the meso- and metathorax *alpha* and *beta* are small and situated close together on a small pinaculum, *alpha* slightly ventrad of *beta*; *epsilon* and *rho* are on a somewhat larger pinaculum and arranged almost parallel to the preceding pair, *epsilon* being over twice as long as *rho*; *kappa* and *eta* are vertically placed on a pinaculum on anterior margin, *theta* being in a line with *kappa* on a circular pinaculum on posterior margin of segment; the *Pi* group is unisetose, the pinaculum being large and semioval. On abdominal segments I-VIII *alpha* and *beta* are on separate pinacula, the former anterior pair slightly closer together than the *beta* pair near posterior margin of segment, a small black dot being present on each *alpha* pinaculum near inner anterior corner; the long *rho* seta is on a large pinaculum almost directly dorsad of the spiracle except on VII where it is distinctly caudodorsad and on VIII where it is somewhat cephalodorsad (on abdominal II and VII the pinaculum is reduced in size but this may not be constant); *kappa* and *eta* are situated obliquely on a large, longitudinally oval pinaculum, well below the spiracle on the anterior portion of segment; *theta* is absent and *mu* is on a large pinaculum practically in a line with *pi* of the thoracic segments and well ventrocaudad of the *Kappa* group. The *Pi* group is trisetose on segments I-VI, bisetose on VII and unisetose on VIII; on those segments with prolegs the pinaculum bearing the setae is slightly anterior and dorsad to the base of the proleg. On segment IX the *beta* setae are slightly closer together than on other segments, *alpha* is on a single pinaculum with *rho* and in practically a horizontal line with same; *eta* and *pi* alone are present of the other groups and situated one above the other as in Fracker's fig. 49.

Pupa.—Rather slender, deep brown, shining, the abdominal segments very finely shagreened; the sheaths of the maxillae, meso-thoracic legs and antennae extend to the caudal end of the wing-sheaths and are subequal; the metathoracic legs form two short, blunt projections beyond the maxillae and on emergence of the adult are sometimes pushed considerably caudad. The front is evenly rounded; there are small, hour-glass shaped pits on meso- and metathorax at base of each wing, mentioned by Mosher (p. 77) as characteristic of the genus *Phlyctaenia*; in contradistinction, however, to her further characterisation, the setae of thoracic and abdominal segments are very fine, short and not forked; dorsally they consist of a subdorsal pair situated near anterior margin of each segment, the lateral and ventral setae being much shorter and most inconspicuous. The cremaster is well-developed, bluntly truncate and strongly rugose with two long hooked setae

and two shorter ones (two-thirds the length) on each side apically. The spiracles are small, oval and slightly raised.

PHYCITINAE.

Epischnia boisduvaliella Gn.

There is a certain amount of doubt as to whether the species before me is the same as the European one to which the above name was given. However, in view of the great similarity of the early stages and of the habitat, I am using the name *boisduvaliella** for specimens both collected and bred at White Point Beach in preference to any of the other available names largely based on very scanty western North American material, and the correct application of which I am unable to determine at the present moment. It might be noted that besides occurring on the sea-coast in Nova Scotia the species is before me from Manitoba, Alberta and British Columbia, the western specimens fitting in quite well with Ragonot's diagnosis of the variety *tabulella* from eastern Siberia. The only detailed account of the life history of *boisduvaliella* appears to be that of Lafaury (1885, Ann. Soc. Ent. Fr. 398). At White Point Beach I found larvae plentiful in July on Beach Pea (*Lathyrus maritima*). The young larvae, which have black heads and a black thoracic plate, live mostly in the terminal buds of the plant; when more mature they burrow into the pods, feeding on the peas, a single larva often entirely destroying the contents of several pods before attaining maturity. Out of a number of mature larvae only two pupated and produced adults in early August; the remainder spun a globular hibernaculum of white silk and will not pupate until spring, a habit that has been commented on by several European entomologists.

Larva—Light green color with a dorsal, a subdorsal and two lateral longitudinal stripes of a darker green color, these equi-distant from each other and all distinctly defined. The head is pale flesh-color, somewhat mottled on the apices of the lobes with brown and with the labrum and mandibles heavily shaded with dark brown; the posterior margins of the lobes are narrowly blackish and there is some black shading around the ocelli. The prothoracic shield is similar in color to the head, slightly mottled with brown and with a black spot on each side near lateral edge and directly posterior to the *gamma* seta; the *beta* seta is closely associated with *alpha* (Fracker, fig. 47). The anal plate is lightly chitinated and pale. Spiracles black, rather small, those on prothorax and abdominal segment VIII larger than the others. Setae short, whitish, arising from small, inconspicuous, black bases, pinacula scarcely defined. Legs pale; prolegs with complete circle of biordinal crotchets.

On the prothorax the *Kappa* group consists of two setae, obliquely placed and distinctly ventrad of the spiracle, *kappa* being cephalo-dorsad of *eta* and about half the length; the *Pi* group has its two setae arranged horizontally (Fracker, fig. 47). On the meso- and metathorax the setal arrangement is much as in Fracker's figure 44 with the important exception that *kappa* and *eta* are more or less vertically placed on individual pinacula and rather well-separated; *kappa* is now the longer seta and at times is slightly caudad of *eta* in position. On the

*It now seems probable that the name *albiplagiata* Pack., based on New Hampshire material, will be available for this species, should it prove distinct from the European one.

abdominal segments Fracker's figure 45 is more or less representative of the setal arrangement but *epsilon* is not present and the two setae of the *Kappa* group are obliquely placed on segments I-VI, much as on the prothorax; on segment VIII and partially on VII, however, they are horizontal as in the figure; the two *beta* setae on VIII are closer together than the *alpha* ones. The *Pi* group is generally bisetose on segments VII, VIII and IX, the other setae on IX being similarly arranged to Fracker's fig. 46.

On the head the ocelli 2, 3, 4 and 6 are in an almost rigidly oblique line and equidistant, 1 and 5 being caudad of 2 and 6, respectively, the distance being about twice that between 2 and 3. The junction of the adfrontal sutures on the epicranial suture seems on the whole to be closer to the front than to the vertical triangle, but there is considerable variation and the character hardly seems a suitable one to differentiate genera as has been done by Fracker (p. 89).

Material of *Epischnia* species was unavailable to Fracker; the genus is therefore not mentioned in his keys, but would fall somewhere near *Euzophera* in so far as it is possible to apply them.

Pupa.—Light brown, rather shining, slender, with evenly rounded front, wing-cases extending to posterior margin of abdominal segment IV; maxillae and mesothoracic legs subequal, antennae slightly shorter. Dorsally the metathorax and the first seven abdominal segments are strongly pitted except on posterior margin; ventrally pitting is present but not so strong on the anterior half of abdominal segments V-VII, the first two showing also traces of proleg scars; segment VIII shows faint pitting dorsally in central section but none ventrally and IX and X are smooth. Faint dorsal furrow present between segments IX and X; cremaster absent, the caudal end being broadly rounded and furnished with a curved row of six minute hooked setae arising from small tubercles and arranged three on each side. Abdominal spiracles small, oval, reddish, slightly raised, thoracic tubercles not marked, abdominal setae extremely minute.

PTEROPHORIDAE.

Pterophorus evansi McD.

Larvae of this species were not uncommon on *Scutellaria* at White Point Beach in late July. They have the habit of eating away a portion of the main stem, causing the terminal shoot to bend over and wilt; in one of the curled up leaves thus formed a larva is almost certain to be found. The pupal stage lasted about ten days and the moths emerged during the early part of August.

Larva.—Head pale with some darker marbling on posterior portion of each lobe. Body cylindrical, pale greenish, turning pink when mature, with broad pale subdorsal stripes and traces of two pale oblique lateral stripes on each segment, usually consisting of an anterior short streak and a posterior dot, both stripes situated dorsad of the spiracle. Integument very finely shagreened and sparsely covered with a growth of short, white, secondary, clubbed hairs; setae long, pale brownish, arising from pale, knob-like verrucae, a number of them being very faintly bifid at the tip. Prothoracic and anal plates pale, not well-defined. Spiracles raised, conical, especially that of prothorax and eighth abdominal segment. Legs pale yellowish; prolegs with a semicircle of five crotchets on inner margin, anal claspers with seven crotchets. (In the following description I designate as primary those setae arising from distinct tubercle-like bases.) The prothoracic

plate, besides a large number of short white secondary hairs contains a row of moderately long bifid setae on the anterior margin, projecting forward over the head; four similar setae occur, two on each side, posterior to *delta*. The usual six primary setae are very long, the anterior row of three being simple and projecting forward, the posterior row of *beta* and *rho* shorter than *delta* and bifid at tip, *delta* being quite close to *beta* and latero-caudad of same. On prothorax anterior to the spiracle and slightly ventrad of same the *Kappa* verruca bears three long seta arranged in form of an equilateral triangle, the two anterior simple and directed forward, the posterior one somewhat shorter, bifid at tip and erect; this would upset Fracker's placement of the Pterophoridae in the Pyralidoidea. The *Pi* verruca contains two simple setae placed obliquely and directed slightly forward. On meso- and metathorax the *Beta* verruca contains two primary setae of which the posterior one (much reduced on metathorax) is longest and simple; there are further two moderately long secondary bifid setae; directly posterior to this verruca is a single, moderately long, bifid seta, pointing backward. The *Rho* verruca contains two bifid setae, placed more or less horizontally with several small secondary setae arranged around the base. The *Kappa* verruca shows three long primary setae, the posterior one bifid and the anterior one ventrad of the other two which are more or less horizontally placed; besides these there are three or four moderately long secondary setae. The *Pi* verruca bears two simple setae, placed horizontally.

On abdominal segments I-VIII the *Beta* verruca contains two primary, bifid setae and two secondary ones on posterior edge. The *Rho* verruca has a single primary bifid seta with anterior and posterior secondary ones. The *Kappa* verruca bears two primary setae, placed obliquely, the postero-ventral one being simple and with a secondary seta directly dorsad of it, these three setae forming more or less of an equilateral triangle. *Mu* is present, simple and directed backward; the *Pi* group is trisetose except on abdominal segments I and VII where it is bisetose and on VIII where it is unisetose. All the above verrucae bear shorter setae scattered around their bases. Single short setae occur posterior to both the spiracle and the *Kappa* verruca. On segment IX both the *Beta* and *Rho* groups are bisetose, the arrangement on *Beta* being similar to that of the preceding segments, the two setae of *Rho* being obliquely placed; the *Kappa* group is also bisetose with setae almost vertically placed and *Pi* is unisetose. The above arrangement of primary seta agrees therefore very closely with Forbes' figure 405 (1924, Mem. 68, Cornell Agr. Exp. Sta., 640), of the setal pattern of *Platyptilia rhododactyla*.

An interesting conjecture might be made from a study of the two structural types of dorsal setae of the thoracic segments. On the prothorax *beta* has a bifid tip whilst *alpha* and *delta* are longer and simple; on the mesothoracic verruca the anterior seta is similar to the *beta* one of prothorax in both position, size and bifid nature of tip and I believe can be safely claimed to be homologous with the prothoracic *beta*. What then is the latero-posterior seta which is longer and simple? Its position and characteristics would certainly suggest *delta*, unless we are willing to believe that *alpha* has wandered posterad of *beta* or else that *alpha* has become bifid-tipped and *beta* simple-tipped, neither of which conjectures seems logical. It should be further noted that this same seta is very much reduced in size on the

metathorax. A study of all the larval stages, especially of the first one, might throw light on the subject.

Pupa.—Pale brown, with wing-cases, metathorax and first two abdominal segments frequently a deep bright brown. Cephalic portion obliquely truncate; subdorsal ridges extend backward from the anterior margin of the metathorax, very sharply defined and more widely separated from each other on the first three abdominal segments, scarcely visible on the mid-abdominal segments, but again quite definite on IX and X. The antennal sheath has a row of short hairs and there are three rows of somewhat longer hairs on the wing sheaths. On the meso- and metathorax there are a number of simple setae, some of them quite long and stout, mostly situated along the line of the subdorsal ridges. On the abdominal segments a prominent verruca is situated on the subdorsal ridge; this bears three stout, simple, apical setae, slightly rugose and arranged in fan-shape, and several strong lateral setae one of which is directed caudad. Dorsad of the ridges segments II-VII bear two short setae situated close to mid-dorsal line. Two small lateral verrucae, situated caudo-dorsad and caudoventrad of the spiracle each bear two and three short setae, respectively. Ventrad again of these on IV-VI is a small verruca with a single minute anterior and a longer posterior seta, directed caudad; the anterior seta disappears on VII and VIII. Spiracles small, whitish, tubular. A bunch of numerous small hooked setae on cephalo-ventral margin of segment X and a very large number of similar setae on the rather pointed cremaster, laterally and apically. The pupa is in general quite similar to that of *temuidactylus* Fitch, but in this latter the setae on the wing-sheaths are much shorter and less developed, the subdorsal ridges are scarcely as prominent and the two pairs of small dorsal tubercles between these ridges are entirely lacking.

Adaina montana Wlshn.

The flat, pale green larvae were not uncommon at White Point Beach in July on a *Solidago* species; as indicated by Barnes and Lindsey, who quote Kellcott, (1921, Contributions, IV (4) (366) they occur mostly on the upper side of the leaf close to the mid-rib. Pupation took place in late July and the adults hatched out during the first and second weeks of August; most of the specimens show considerable sprinkling of brown on the primaries and some of them fit in quite well with the figure of *declivis* Meyr. (*op. cit.* Pl. XLII, fig. 2), far better, indeed, than with Walsingham's original figure, which is hardly recognizable. I have seen no material from the Pacific Coast; the species is, however, not uncommon in Ontario. I unfortunately overlooked securing any larvae for future study, but offer the following notes on the pupa which will augment Kellicott's rather brief remarks.

Pupa. Much compressed dorso-ventrally, the ventral surface being quite flat and comparatively free from setae, the dorsal surface gently rounded and thickly covered with long setae and sparse, short, secondary hairs; the front rather squarely truncate. The lateral line between the two surfaces is formed on the cephalic half by a row of long white setae jutting out at right angles to the surface and arranged along the dorsal edge of the mesothoracic wing-sheath; on the abdominal segments this is continued by fan-shaped bunches of white setae arising from prominent, lunate, subspiracular verrucae. The color is quite variable; some pupae are quite pale greenish, with a diffuse brown dorsal stripe; in others this

stripe is augmented by paired, oblique lateral stripes and others again may be so suffused with dark shading, both dorsally and ventrally, that the pale color only appears as a couple of broken oblique lateral stripes. The bases of the antennae and the front show a number of long, white, simple setae, those on the front directed forward; the clypeus bears six short setae and the eye-sheaths two quite minute ones; besides the row of hairs already mentioned near the edge of the mesothoracic wing-sheath, there is a parallel and closely approximate row of much shorter setae on the extreme edge and a third row of still more minute hairs on the metathoracic sheath. The prothorax shows a fringe of moderately long white setae along the anterior edge and in the median area and further two long dorsal and two similar lateral setae. The mesothorax is quite thickly covered with short white secondary hair; it bears a single long white seta on the anterior margin subdorsally; caudad of this is a pair of long setae and ventrad of these another pair of similar ones, anterior to which a faint scar apparently indicates the mesothoracic spiracle; several shorter setae occur near the posterior margin and there is a small tuft at base of wing-sheath. The metathorax, as well as the first three abdominal segments, shows considerable short white secondary hair; the long dorsal setae, from this segment caudad, are brownish and the lateral ones white; on each side of the median line on the anterior margin of metathorax are two pairs of long setae and there is a very short white subdorsal one, pointing forward, on posterior margin. On the abdominal segments the *alpha* and *beta* groups are represented by long single setae pointing respectively forward and backward; somewhat cephalo-dorsad of *beta* is a short, stout, seta and several very minor ones around base; in the median line between the *beta* setae are two short setae directed backward. The spiracles on segments II-VII are prominently raised, blackish, conical, that on II being longest; immediately dorsad of the spiracle is a white seta pointing forward and ventrad of the spiracle is a semicircular group of five or six white setae on a small verruca; the lunate verruca containing the fan-shaped arrangement of five or six long white setae, already mentioned, is somewhat caudo-ventrad of this. On the ventral surface there is a lateral group of setae consisting of one rather long white seta directed forward and a much shorter one pointing caudad; midway between this and the midventral line are two short white setae on segments IV-VIII. The ventral surface of the tenth segment is more or less thickly covered with small knobbed and apparently somewhat glutinous setae, concentrated into a strong group on the cephalic margin; the cremaster is also furnished with very numerous setae of a similar character.

OECOPHORIDAE.

Agonopteryx hyperella Ely.

The larvae of this species were very plentiful in certain of the dryer cranberry bogs near White Point Beach in July. They live concealed between the two, spun-together, terminal leaves of *Hypericum virginicum*. When mature they leave this shelter and spin a cocoon amongst debris; pupation does not take place for a couple of weeks and the adults emerge in the second week of August. Larvae were also found at Milford webbing the flower-heads of *Hypericum perforatum*. The larva has a pale reddish head with dark brown shading over the mouth-parts and around the ocelli and a rather prominent dark spot on the postero-lateral section of each lobe. The abdomen is pale green with neither prothoracic nor anal

plate prominent; the black-ringed spiracles are quite conspicuous; the setae are minute and arise from slightly tubular bases, the pinacula being scarcely defined. The legs are pale and the crochets of the prolegs form a complete circle, arranged biordinally. On the head the ocelli are arranged much as in Fracker's figure 80, the second ocellus being distinctly closer to the third than to the first; I cannot however, see that the fourth is closer to the third than to the sixth, as Fracker claims, as these three ocelli are almost contiguous to each other, forming an oblique row. The adfrontals extend distinctly to the vertical triangle; the posterior epicranial puncture is well dorsad of P_2 and very slightly caudad of same; the anterior epicranial puncture is situated close to A_2 , slightly dorso-cephalad; puncture P_3 is dorsad of L_1 and almost in a straight line with it and P_2 ; the setae P_1 , P_2 and Adf , form an oblique line.

On the prothoracic plate the setal arrangement is much as in Fracker's figure 39, but the small *rho* seta is not so far dorsad of *eta*; *beta* is quite minute whilst *delta* and *eta* are the longest setae on the plate. The *Kappa* group is trisetose and situated well cephalad and slightly ventrad of the spiracle; the middle seta is much the longest and stoutest and is somewhat ventrad of a line drawn between the two outer setae and slightly closer to the anterior one. The *Pi* group is bisetose, the two setae placed horizontally almost directly ventrad of the *Kappa* group; the posterior seta is much the longer of the two.

On the thoracic segments the setae are arranged much as in Fracker's figure 40 except that *theta* is rather more ventrad and closer to the *Kappa* group; the setae *beta*, *rho* and *kappa* are more than twice the size and length of the other setae. On the abdominal segments Fracker's figure 45 gives a general idea of the setal pattern on segments I-VIII, but *epsilon* is entirely missing, *rho* is slightly cephalad of the spiracle on most of the segments and decidedly so on VIII; in the *Kappa* group the *kappa* seta is, as usual, the longer of the two and its position is in general directly caudad of *eta*; some slight variation on individual segments is evident, but not sufficient to warrant Fracker's statement in paragraph 3 on page 85. The *Pi* group is bisetose on VII and unisetose on VIII. Segment IX corresponds to Fracker's figure 56, but, as the ventral seta of the *Kappa* group is much the longer of the two, it would seem to be homologous with *kappa* of the preceding segments and not *eta*, as marked in the figure. The anal plate is broadly hemispherical.

Pupa. Smooth, light brown, short and chunky, very similar to Mosher's figure 97 except that the prothoracic femora are not exposed and the maxillary palpi do not touch the proximo-lateral angles of the maxillae; the antennal sheaths show a single row of small wart-like prominences in their apical two-thirds. The wing-sheaths are not pointed and extend only to the posterior margin of IV. The abdominal setae are very minute and the three segmental sutures posterior to segment IV are very deep. Spiracles small, dark, slightly raised, especially on VIII. Scars of prolegs visible on V and VI. About six minute hooked setae on each side of the anal slit: traces of a cremaster present with four small hooked terminal setae and another row of four similar ones dorsad of these.

EUCOSMINAE

Anchylopera maritima Dyar

Larvae of this species were found in July at White Point Beach living, as indicated by Dyar, between two drawn-together leaves of Beach Pea and pupating in the same habitation. The larva in light yellowish and very similar generally to that of *semiovana* Zell. as recently described by me (1933, Can. Jour. Res. IX, 512). The head shows the same black shading around the ocelli and on the postero-lateral margin of the lobes and the pale prothoracic plate has similar lateral black patches; on the anal plate the dark shading is reduced to two lateral spots much as on prothorax. The integument of thorax and abdomen is much more heavily shagreened dorsally than in *semiovana* and presents a distinct roughened appearance and the pale verrucae are somewhat smaller. *The anal fork is entirely lacking* in the specimen under examination. The setal pattern is almost identical with that of *semiovana*; it might be noted that *alpha*, *beta* and *rho* on IX form practically an equilateral triangle, *alpha* being equidistant from *beta* and *rho* and well cephalad of same. The *Kappa* group on IX consists of three vertically placed seta. The *Pi* group appears normally trisetose on segments VIII-IX, not bisetose as in *semiovana*, but this is somewhat variable as on VIII in the same larva one side is trisetose and the other bisetose.

The pupa is quite typical for the genus and extremely similar to that of *semiovana*.

Ancylis comptana Froel.

Several specimens were bred in August (evidently a second brood) from larvae on wild strawberry at White Point Beach, but I have no notes other than that the larva was yellowish green, slender and quite lively. The pupal case shows great resemblance to that of the preceding species in general characters and the only difference that I noted is that the spines of the transverse dorsal row on IX are much reduced in size and rather irregularly placed.

Of the four adults before me one male is as dark in color as typical *comptana*, the other three (1 male 2 females) are lighter brown and would probably fall under the varietal name *fragariae* Walsh and Riley, evidently a mere color-form.

TORTRICIDAE

Cacoecia myricana McD.

The larvae of this species were extraordinarily numerous in July on the *Myrica* bushes bordering a small lake at White Point Beach; fully 90 per cent. of them, however, were parasitized by a *Meteorus* species. With this large amount of material available for study I am able to offer additional notes on the larva to augment and partially to correct my previous description (1933, Can. Jour. Res. IX, 506) based on field notes and a single specimen in alcohol. In the immature larvae apparently the head and prothoracic shield are entirely blackish; in fully mature ones the head is pale orange-red with black markings as indicated, and at times entirely without darker marbling on the lobes. The prothoracic shield is broadly suffused with blackish along lateral and posterior margins, but shows considerable shading of the same color as the head in the antero-median section; it was never found to be as pale as in the previous description. Dorsally the entire body is uniformly dark olive-green without traces of paler stripes but with the whitish pinacula showing up much more prominently than was indicated previously; the dorsal

integument is very faintly and transversely rugose; laterally the color is a dull dirty whitish, contrasting considerably with that of the dorsum. In the long series of adults obtained both by breeding and by beating the *Myrica* bushes in late July about two-thirds of the specimens were fairly typical; the remainder tended in both sexes toward a paler, more yellowish form with suffused maculation, in color somewhat similar to *eleagnana* McD.

Peronea oxycoccana Pack.

Packard based his name for the species on the statement, credited to Sanborn, that the larva fed on cranberry. In none of the bogs in the neighborhood of White Point Beach which I visited could I find any traces of the larvae on this plant, but they occurred quite plentifully in one bog on *Chamaedaphne* (leather leaf) in late July tying up the terminal shoots; pupation took place the second week in August and the moths emerged the latter part of the month. In the small series of adults secured the forewings in all specimens were of a glistening ruddy brown (not the usual black-brown) and in the paler specimens the costal triangle was visible as a series of three spots.

Larva. Head flat, rather broad, pale orange, shaded over the mouth-parts with brown, and with traces of a dark edging along the posterior margin of the lobes. The body is entirely pale yellowish with small white setae arising from rather inconspicuous pale pinacula. Legs pale; spiracles small, ringed with light brown. Integument dorsally distinctly shagreened, presenting a decided roughened appearance. Anal plate bluntly conical; fork with about six prongs.

On the head the setal pattern appears to be more or less similar to that of *P. cornana* McD. (1933, Can. Jour. Res. IX, 509), P_1 , P_a and P_2 being in practically a straight line and P_1 almost directly ventrad of the adfrontal puncture; the arms of the epicranial suture as in figure 5 (*op. cit.* p. 504).

On the prothorax the setae *alpha*, *delta* and *epsilon* are much the longest, *beta* is quite minute and *rho* (in the single alcoholic specimen available for examination) is represented by two small setae. In the *Kappa* group the longer middle seta is distinctly ventrad of a line between the other two and is situated about twice as close to the anterior as to the posterior seta. In other respects the setal arrangement is normal for the genus and as indicated for *cornana* (*op. cit.* p. 510).

Pupa—Shiny brown and quite typical of the genus. The front is evenly rounded, not raised above the level of the antennae and without projection. The setae are minute, but tend to lengthen on the two posterior segments. Caudal rows of dorsal spines on VIII and IX lacking entirely in the female and very faint on VIII in male, the cephalic row on IX considerably reduced. Two *simple* setae on each side of the caudal end of the anal slit. Cremaster, as usual, curved ventrad and with sharp lateral points, rugose, furnished with a ventro-apical row of four *simple* (or faintly bent) setae and two dorso-apical similar setae at the base of each lateral projection.

Peronea kearfottana McD.

The larvae were very plentiful tying up the terminal shoots of Sweet Fern (*Comptonia*) at Annapolis in late June, adults emerging in mid-July; a single specimen was also bred from a larva on *Myrica* at White Point Beach. The pale greenish caterpillar with light orange head is very similar to that of *cornana* McD.

(1933, *op. cit.*, 509). On the head the mouthparts are shaded with brown and there are black areas around the ocelli and in postero-lateral corners of lobes; the arms of the epicranial suture are slightly concave but not markedly so. The body integument is faintly shagreened dorsally and the pinacula are pale with the exception of the prothoracic ones which are more heavily chitinized and consequently tinged with brown; the pale prothoracic plate is narrowly tinged with brown along its posterior edge. The legs are black-brown. The anal plate is pale and hemispherical and the anal prongs small. On the prothoracic *Kappa* pinaculum the middle seta is quite close to the anterior one and slightly ventrad of same; the general setal arrangement is quite typical for the genus and similar to that of *cornana*.

Pupa—Brown with nothing of a very characteristic nature and quite typical for the genus. The abdominal setae are shorter than in the preceding species, as is also the case with the setae of the anal rise and the cremaster, these at times becoming quite atrophied.

ADDITIONS TO THE HISTERIDAE OF LOWER CALIFORNIA. (COLEOPTERA)

BY HOWARD E. HINTON.

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In 1894 Horn (Proc. Cal. Acad. Sci. ser. 2, IV) recorded twelve species of Histeridae as occurring in Lower California. One, *Carcinops viridicollis* Mars., was omitted, but Lewis (1888) and Leng (1920) both record it from Lower California, and one, *Iliotona beyeri* Schffr. (1907), has since been described from this region. In the present paper, one known and three new Histeridae are added to the list, thus raising the total number from this region to eighteen.

***Saprinus scissus* Lec.**

Numerous examples were taken under and in decaying seaweed on the beach at Ensenada, May 23, 1934 (H. E. Hinton). In company with the above species, one specimen of *Hypocaccus bigmmeus* (Lec.) was also taken.

***Hypocaccus prosternalis* n. sp.**

Widely obovate, convex, black, shining; elytra somewhat piceous, antennal club fuscous, antennae, mouth-parts and legs somewhat rufo-piceous.

Head with the frontal stria rather fine and complete; supra-orbital striae moderately fine; front feebly convex, nearly flat, without other impressed lines posterior to frontal stria; surface finely, moderately densely punctate, with the punctures becoming finer and sparser basally and with a few extremely fine punctures sparsely intermixed throughout.

Prothorax one-half wider than long; apical marginal line fine and complete; lateral line coarser, complete and moderately distant from lateral margin posteriorly; sides straight basally, feebly arcuate anteriorly, converging moderately towards apex; base feebly bisinuate, not margined; surface very finely, sparsely punctate throughout, with these fine punctures becoming slightly denser and coarser at sides, near sides with an area of coarse, dense punctures which are more numerous apically, base with a belt of coarse, dense punctures which are nearly absent at extreme sides and in front of scutellum.

Elytra four-fifths longer than prothorax; surface with a large, only microscopically punctate scutellar mirror extending to apical one-third at middle and near base extending to the humeral impunctate area, surface elsewhere densely, coarsely punctate with the punctures separated mostly by about their own diameters; sides between impunctate humeral area and epipleura coarsely, densely punctate; striae coarse, well impressed, coarsely, closely punctate; sutural extending to basal one-third and thence faintly traceable to base where it is joined in a broad arch to second, second extending beyond apical one-half, third slightly shorter, fourth as long as second, fifth as long as third; humeral (sixth) interrupted in basal one-third and extending to apical one-third, outer humeral present only on basal one-third; scutellum wider than long.

Propygidium about one-fifth as long as pygidium, coarsely, densely punctate with these punctures separated by less than their own diameters and with an occasional finer puncture intermixed, apex only finely, moderately sparsely punctate.

Prosternum moderately convex, moderately wide and not compressed between striae; striae widely diverging caudally, nearly parallel at middle, widely diverging anteriorly and ending in moderate foveae near apex; carina in front of anterior coxa sinuate at middle and there joined to prosternal stria and both extending to apical fovea. Mesosternum with elevated portion limited posteriorly by a straight line; marginal stria in front complete and deeply, broadly arcuate; surface moderately densely, coarsely punctate, with the punctures more numerous basally at sides. Metasternum microscopically punctate, sides and sides of base coarsely, moderately densely punctate; disk of first ventral segment microscopically punctate, sides coarsely, rather densely punctate. Length, 3.8-4.8 mm.; breadth, 2.5-3 mm.

Type: Deposited in the British Museum. Lower California, 1907.

Paratype: One with the same data as above.

In the paratype the frontal stria is nearly obsolete medially, the scutellar mirror only extends to apical one-half, and the sutural elytral stria is well impressed to base.

The structure of the prosternum will enable it to be separated from the other species of *Hypocaccus* occurring on the West Coast.

***Hypocaccus strigithorax* n. sp.**

Widely obovate, convex, black, feebly shining and with a feeble aeneous lustre; antennal club greyish, antennae, mouth-parts and legs rufo-piceous.

Head with frontal line and supra-orbital striae moderately coarse; surface feebly but distinctly rugose medially behind marginal line, elsewhere finely, rather densely punctate with the extreme base much more finely punctate.

Prothorax one-half wider than long; apical and lateral marginal line moderately coarse, complete; sides feebly, broadly sinuate at middle, converging feebly towards apex; surface moderately coarsely, densely strigose except middle of disk and base; middle of disk with an area near base nearly impunctate, elsewhere slightly coarsely punctate with the punctures becoming coarser and denser towards strigose area; base near middle with a moderately long belt of coarse, extremely dense punctures, with the belt becoming shorter towards sides and nearly absent at extreme sides; base nearly evenly arcuate, not margined.

Elytral surface with the scutellar mirror, humerus, a narrow area at extreme side and epipleura nearly impunctate, elsewhere coarsely, extremely densely punctate, with the punctures separated by less than their own diameters and very faintly strigose near apex; scutellar mirror small, about one-fourth as long as elytra, sharply defined; striae feeble, closely punctate; sutural present only on basal one-third, broadly arched to second which is very short, third and fourth short, scarcely visible, fifth feeble, extending to basal one-half; humeral (sixth) present only for a short distance at middle, outer humeral absent; scutellum very small, equilateral.

Propygidium one-third as long as pygidium; punctures coarse and separated by less than their own diameters, with extreme base only finely punctate. Pygidium with a small, round, feeble impression on each side of middle near apex; surface coarsely punctate, with the punctures separated by about or slightly more than their own diameters.

Prosternum narrow, feebly convex and indistinctly punctate between striae, at sides slightly coarsely, moderately densely punctate and microscopically alutaceous; striae widely diverging at caudal end, thence parallel and extending nearly to apex, not joined; carina in front of anterior coxa arcuately converging towards apex where they are joined in a broad arch, noticeably sinuate above apical foveae. Metasternum elevated, with the posterior limiting line nearly straight, strongly crenate and superimposed on the meso-metasternal suture; marginal stria complete, sinuate at middle on front; surface slightly coarsely, moderately densely punctate, with a few finer punctures intermixed and throughout microscopically alutaceous. Metasternum impunctate except for a narrow belt of fine, moderately dense punctures at caudal end; impunctate area in parts microscopically punctate. Middle of first ventral segment with a few fine punctures at sides and a single, even row of fine, close punctures near apex; surface microscopically punctate throughout. Length, 3 mm.; breadth, 2 mm.

Type: In the collection of the writer. Ensenada, May 23, 1934 (H. E. Hinton).

The single specimen was taken under decaying sea-weed on the beach. It should be easily recognized by the strongly strigose front and sides of the pronotum. The writer can relate it to no species known by him.

In *Saprinus* and allied genera, the second elytral stria is usually completely absent, so that it is customary to speak of what is in reality the third as the second, thus the humeral stria would be the sixth and the outer humeral the seventh. Too often authors describe the inner margin of the epipleura as the outer humeral stria! In describing species of Histeridae, the writer has found it much less confusing to number the striae from the suture outwards. Unfortunately, at the present time some writers number the striae from the outer discal to the sutural.

***Baeckmanniolus balloui* n. sp.**

Oblong, broad, subparallel, strongly convex, black, strongly shining; elytra dark piceous and with a feeble metallic lustre, antennae, mouth-parts and legs dark rufo-piceous.

Head without impressed lines behind frontal stria, apparently impunctate.

Prothorax twice as wide as long; apical and lateral marginal line complete; sides very sinuate on basal one-half, converging moderately towards apex; base very feebly bisinuate, margined except on middle one-third; surface impunctate except at extreme base where there are two rows of coarse, often confluent punctures which are slightly coarser in front of scutellum.

Elytra one-half longer than prothorax; humeral area and side only finely, sparsely punctate, elsewhere coarsely, moderately densely punctate, with the punctures becoming finer and much sparser on basal one-fourth; striae rather coarse, and closely punctate; sutural complete, joined in a broad, feebly interrupted arch to second, second extending to apical one-half, third shorter than second, fourth about as long as second, fifth as long as fourth but briefly interrupted before end; humeral present on middle at side for a short distance, outer humeral absent; scutellum very small, wider than long.

Propygidium about half as long as pygidium; surface minutely alutaceous throughout and coarsely, densely punctate on basal four-fifths, with coarse punctures separated by less than their own diameters. Pygidium coarsely, densely punctate throughout, punctures denser apically.

Prosternum with the two carinae visible the entire length, both extending to apex; carinae in front of anterior coxae prominent, joined to middle of prosternal carinae and both then continued to apex. Mesosternum coarsely, moderately densely punctate; posterior limiting line strongly crenate. Metasternum nearly impunctate on anterior one-half, near apex coarsely, moderately densely punctate, with a few finer punctures intermixed. Anterior tibiae with two very prominent subapical teeth and one less prominent apical tooth. Length, 2.9 mm.; breadth, 2 mm.

Type: In the collection of the writer. Ensenada, May 23, 1934 (H. E. Hinton).

The single specimen was taken on the beach under decaying sea-weed. The writer takes pleasure in naming this distinctive little species for Mr. C. A. Ballou Jr.

Baeckmanniolus balloui Hntn. is most closely related to *B. guardens* (Lec.), but the elytra are more coarsely and densely punctate, and the base of the prothorax is margined except on middle one-third. The following table will serve to separate the American species of *Baeckmanniolus* Rchdt.:

A KEY TO THE AMERICAN SPECIES OF *BAECKMANNIOLUS* RCHDT.

1. Elytra with the sutural stria absent. Brazil..... *dolatus* (Mars.) 1862
- Elytra with the sutural stria present 2
2. Head behind frontal line smooth..... 3
- Head behind frontal line with an arcuate, usually irregular line..... 4
3. Base of prothorax margined except on middle one-third; mesosternum with the posterior limiting line strongly crenate. Lower California.....
..... *balloui* Hntn.
- Base of prothorax not margined; mesosternum with the posterior limiting line not crenate. California, Mexico *guardens* (Lec.) 1851
4. Pronotum with a small, densely punctate area anteriorly near sides. Mexico *consputus* (Mars.) 1855
- Pronotum impunctate anteriorly..... 5

5. Elytra with basal third nearly impunctate, and with apical half only slightly coarsely, moderately densely punctate. Eastern United States.....
 *palmatus* (Say) 1825
 — Elytra with basal third rather coarsely punctate, and with apical half coarsely, densely punctate. California *serrulatus* (Lec.) 1851

In 1926 Reichardt (Entom. Blatter, p. 12-16) erected the genera *Neopachylopus* and *Baekmanniolus* each to contain species which had formerly been placed in *Pachylopus* Er. Reichardt (l. c.) refers all of the other species of *Pachylopus* Er. (*sensu* Bickhardt, 1917), except the genotype *P. dispar* of Africa, to one or the other of his new genera. In so doing, he incorrectly places one American species, and fails to place two other American species on account of lack of material. In the Lewis collection of Histeridae deposited in the British Museum, there is a specimen of *serrulatus* (Lec.) which clearly belongs to *Baekmanniolus* Rchdt. and not to *Neopachylopus* Rchdt., as the carina in front of the anterior coxa (outer prosternal stria of Reichardt) are prominently extended to the apex of the prosternum.

In the above mentioned collection in the British Museum, there is a specimen of *Pachylopus dolatus* (Mars.) from Brazil which should be placed in the genus *Baekmanniolus* though the carina in front of the anterior coxa does not attain the apex, but ends in a deep subapical pit. Before the writer is a good series of *consputus* (Mars.) which should be placed in the genus *Baekmanniolus* Rchdt., as the carina in front of the anterior coxa attains the apex of the prosternum.

SOME BUTTERFLIES OF SOUTHERN NEWFOUNDLAND WITH DESCRIPTIONS OF NEW SUBSPECIES (LEPID. RHOPAL.)

See v. 67 p. 72. 1943.

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The Island of Newfoundland is divided into three faunal zones—Arctic, Hudsonian and Canadian. The latter two are of about equal size but the first is only a narrow strip along the North and North East coasts. The collection hereinafter referred to came exclusively from the southwestern part of the island in the Canadian zone. The locality is interesting because this part of Newfoundland remained unglaciated during the last continental glaciation. It possesses a large relict flora of species which have persisted since pleistocene times and it is possible that some insects of that period also survive.

During the summer of 1934, Mr. Hugh McIsaac of Doyles Station, Newfoundland, sent us his entire catch of butterflies, consisting of about four hundred and fifty specimens, representing twenty-one species. We have also studied the material from Newfoundland in the collections of the American Museum of Natural History, the Carnegie Museum and the Canadian National collection.

Doyles Station is about seven miles from the sea, twenty-five miles north of Port aux Basque, and not far from the Great Codroy River. The elevation is in the neighborhood of thirty feet. The country is fairly level. It is timbered with spruce, fir, cedar, alder and poplar. Most of the specimens were taken along the railroad track, in open fields, marshes and barren land. The earliest was caught June 12th and the latest, September 20th. The list follows:

Papilio ajax brevicauda Saunders. 1 ♂ 9 ♀, June 12 to July 18.

No specimen is as deeply colored with orange as the ♀ figured by Holland in the revised edition of the *Butterfly Book* (pl. XL f. 5) although that color is present in some specimens. The majority are similar to the figure of *anticostiensis* Strecker, (Lepidoptera, Rhop. and Het., etc. pl. 2 f. 2), while one ♀ approaches *gaspeensis* McDunnough. It measures 72 mm. against 65 mm. for a specimen of *gaspeensis* before us and there is a diminution of the size of the yellow spots composing the extra-discal rows on both wings, particularly on the hind wings. Another has the spots of the extra-discal rows on both wings elongated inwardly, the light area on the secondaries crossing the outer part of the cell.

Papilio glaucus canadensis Rothschild & Jordan. 46 ♂ 13 ♀, June 20 to July 20.

One ♀ is very heavily suffused with black on the upper side.

Pieris rapae Linnaeus. 11 ♂ 7 ♀, August 13 to September 20.

These are the typical summer form but slightly more heavily suffused with black, especially the ♀, than New England specimens.

Colias philodice Godart. 1 ♀, July 9.

Colias interior laurentina Scudder. 26 ♂ 8 ♀, July 9 to August 8.

There is considerable variation in the amount of black markings on the upper side of the ♀. No white ♀ was received although one is pale yellow. While *Colias interior* Scudder has also been reported from Newfoundland it would seem better to use the name *laurentina* for the small eastern race.

Danaus plexippus Linnaeus. 1 ♀, August 8.

***Coenonympha inornata mcisaaci* n. ssp.**

♂ 34 mm. Primaries, upper side; disk ochraceous tawny*; costal, outer and inner margin light brownish olive. Secondaries, light brownish olive; inner margin, pale olive grey. Primaries, underside; basal area, sage green extending along costal margin but shading into tea green at apex; inner margin, ochraceous tawny. the division between the discal and limbal areas being marked by an irregular line, light brownish olive on the inner side and pale olive grey on the outer side; outer margin, pale olive grey. Secondaries, sage green at base, tea green beyond the cell, which is outwardly defined by a pale olive grey angular mark, reappearing at the anal angle. Fringes of both wings on both sides, pale olive grey.

♀ 33 mm. Primaries, upper side; cinnamon buff, darker at the base, the markings of the under side faintly showing through. Secondaries, clay color, the markings also showing through. Primaries, under side; similar to ♂ but paler, the band broader and more distinctly defined. Secondaries, similar to ♂. The mesial band, pale olive grey continuing almost to the anal angle. The upper and under sides of both wings are bounded by a faint narrow black line and are without ocelli. Fringes similar to ♂.

Antennae, head and body, similar to *inornata*.

54 ♂ 15 ♀, July 1-August 3.

Holotype—♂, July 9, 1934, Doyles Station, Newfoundland.

Allotype—♀, July 9, 1934, Doyles Station, Newfoundland.

Paratypes—Nine pairs, all from Doyles Station, Newfoundland, in 1934, (3 ♂ July 10, 2 ♂ July 14, 1 ♂ July 16, 2 ♂ July 18, 1 ♂ July 28, 1 ♀ July 7, 1 ♀ July 9,

*All color terms are adopted from Ridgway's *Color Standards and Nomenclature*, 1928.

2 ♀ July 13, 1 ♀ July 14, 1 ♀ July 15, 1 ♀ July 18, 1 ♀ August 3). The types have been deposited with the American Museum of Natural History and one pair of paratypes with the Canadian National Museum, the Carnegie Museum, the Los Angeles Museum and the Museum of Comparative Zoology. The remainder are in the author's collection.

C. inornata Edwards (1861, Proc. Ac. Nat. Sc. Phila. 13, 163) was described from Winnipeg. *C. quebecensis* Barnes & Benjamin described from Chelsea, Ottawa Co., Quebec, has been sunk as a synonym. Three western races have also been described (1928, Can. Ent. 60, 272, 273), one from Victoria, British Columbia (*C. insulanus* McDunnough) another from Aspen Grove, British Columbia (*C. columbia* McDunnough) and the third from Waterton Lakes, Alberta (*C. benjamini* McDunnough). The new sub-species appears to be rather local as specimens from northeastern Newfoundland approach *inornata*, the nearest race, quite closely. The new subspecies is extremely uniform in markings, color and size. The contrast between the sexes on the upper side is striking, more so than in any other species of the genus except *haydenii* Edwards. They differ from *inornata* in color on both sides, being darker and more contrasting and in the total lack of ocelli on the wings on the sixty-nine specimens examined.

***Oeneis jutta terrae-novae* n. ssp.**

♂ 55 mm. Primaries, upperside; brussels brown, four cadmium yellow patches near outer margin, containing black ocelli; raw umber hairy androconia covering the lower part of the cell and below vein M_3 . Secondaries, similar to primaries but the basal area covered with brussels brown hair, outer margin with cadmium yellow patches between the veins, the one at anal angle with a black ocelli pupilled with white. Primaries, underside; dresden brown dusted with black and grey at apex, one to three ocelli reappearing, the upper ones pencilled with white—the basal area bounded by an irregular brown line, the androconia showing through. Secondaries, ground color, mummy brown mottled with grey, mesial band, broad and irregular with few grey scales, defined on both sides by grey, but indistinct. Submarginal band, mummy brown with five small pale yellow spots. Fringes of both wings, on both sides black and white.

♀ 54 mm. Primaries, upperside; basal area, raw umber separated from limbal area by a broad dark brown irregular band beyond which is a cadmium yellow submarginal band containing three to five black ocelli, sometimes pupilled with white. In the allotype this band of cadmium yellow is broken by the veins. Secondaries, similar to ♂ but with two pupilled anal spots. Primaries, underside; similar to ♂, all ocelli reappearing and pupilled with white, the irregular band separating the basal and limbal areas distinct. Secondaries, similar to ♂ but mesial band less clearly defined. Fringes of both wings, on both sides, black and white.

Antennae, head and body, similar to *jutta*.

28 ♂ 10 ♀ June 23-August 3.

Holotype—♂, June 23, 1934, Doyles Station, Newfoundland.

Allotype—♀, June 23, 1934, Doyles Station, Newfoundland.

Paratypes—Seven ♂ and five ♀, all from Doyles Station, Newfoundland, in 1934. (1 ♂ June 21, 1 ♂ June 23, 3 ♂ June 29, 1 ♂ July 10, 1 ♀ June 23, 1 ♀

June 28, 2 ♀ July 18). The types have been deposited with the American Museum of Natural History and one pair of paratypes with the Canadian National Museum, the Carnegie Museum and the Los Angeles Museum. The remainder are in the author's collection.

Jutta Hubner (1800-23 Smlg. Eur. Schmett. f. 614, 615) was described from Northern Europe and the name applied to North American specimens, somewhat resembling Hubner's figure. A careful examination of that figure, however, and European specimens (2 ♂ and 2 ♀ from Dr. O. Staudinger and A. Bang-Haas) convinces us that Newfoundland specimens differ in important particulars, being larger, much darker and having a wider submarginal cadmium yellow band. On the underside of the secondaries, the European specimens have a mesial band and outer margin of mouse grey separated by pale mouse grey and have the same color at the base, while the new sub-species has a distinct black and white appearance and the mesial band is not well defined. *Alaskensis* Holland (1900 Ent. News 11, 389) is smaller, duller in color and with more translucent wings and *reducta* McDunnough (1929 Can. Ent. 61, 105) has wide cinnamon buff marginal bands and the underside of the secondaries shows no trace of a mesial band.

***Argynnis atlantis canadensis* n. ssp.**

♂ 57 mm. Primaries, upperside; mars orange shading into auburn at base—black markings similar to *atlantis* Edwards, but heavier, the marginal band being solid. Secondaries, similar to primaries. Primaries, underside; xanthine orange, apex and outer margin, liver brown, six silver marginal spots counting from apex. Two silver spots inside of the first two of the outer rows near apex and two pale yellow orange patches between black irregular band and liver brown area. Secondaries, including outer margin, liver brown irregularly mottled with pale yellow orange patches and silver markings as in *atlantis*. Very narrow pale yellow orange submarginal band broken by veins not reaching to apex or anal angle.

♀ 61 mm. Primaries, upperside; mars yellow, otherwise similar to ♂, but the submarginal black crescents nearly all touching the marginal band. Secondaries, similar to primaries. Primaries, underside; similar to ♂. Secondaries, similar to ♂.

Antennae, head and body, similar to *atlantis*.

18 ♂ 34 ♀, July 20-September 12.

Holotype—♂ July 20, 1934, Doyles Station, Newfoundland.

Allotype—♀, August 8, 1934, Doyles Station, Newfoundland.

Paratypes—Six pairs, all from Doyles Station, Newfoundland, in 1934. (4 ♂ July 20, 2 ♂ August 3, 4 ♀ August 8, 1 ♀ August 18, 1 ♀ August 23). The types have been deposited with the American Museum of Natural History and one pair of paratypes with the Canadian National Museum and the Los Angeles Museum. The remainder are in the author's collection. A ♂ and ♀ in the collection of the Carnegie Museum, taken in copulation (pair No. 1) on July 21, 1934, by Dr. Brooks on Wood Road near Camp 31, Lomond, four miles south of Bonne Bay, west coast of Newfoundland, are also designated paratypes.

Atlantis Edwards (1862, Proc. Ac. Nat. Sc. Phil., 54) was described from specimens taken in the Catskill Mountains, New York, the White Mountains,

New Hampshire, at Williamstown, Massachusetts, Lake Winnipeg, Manitoba, and near Hudson Bay. A specimen is also mentioned from the north side of Lake Superior. It was figured by Edwards in Butt. N. Am. I pl. Argynnis, V. This figure is a heavily marked specimen resembling those from northern localities. We were unable to find it in the Edwards collection at the Carnegie Museum. When Holland originally published the Butterfly Book, he figured (pl. X, f. 9) a ♂ *atlantis* which is very much lighter. In the revised edition, Holland calls this specimen a "paratype" possibly meaning a cotype. This specimen is in the Edwards collection and the label shows that it was taken at Hunter, New York. It is not designated as any kind of a type. Among the other specimens of *atlantis* are two with labels in Edwards' handwriting, giving the name and sex and the locality as "Catskills". "Type" is written across the end of these labels in red ink. In view of the various localities mentioned in the description and the subsequent description of two races, presently to be referred to, it would seem desirable to restrict the type locality of *atlantis*. Edwards states that "specimens from the White Mountains and Hudson Bay are diminutive in size," so they could hardly have been chosen for the type. From the remaining localities, it would seem best to select one in the Catskills since Edwards spent a number of summers at the Mountain House, Hunter, New York, and "found it abundant" in 1861, the year before *atlantis* was described. Upon all the evidence, the type locality is therefore restricted to Hunter, New York. Attention should be called to the fact, however, that the majority of specimens found in the Catskills are not as heavily marked as Edward's figure and the above mentioned "types" but resemble Holland's figure which agrees with a small series (2 ♂ 3 ♀) before us from Stony Clove, New York (about five miles from Hunter) where Edwards also collected. This series was taken by Mr. Frank E. Watson.

Since the description of *atlantis*, two races have been named, *nickias* Ehrmann (1917, The Lepidopterist I 55) from Jemez Springs, New Mexico, and *beani* Barnes & Benjamin (1926, Bull. So. Calif. Ac. Sc. XXV, 92) from Banff, Alberta. The former has been sunk as a synonym of *atlantis* by Holland (Butterfly Book rev'd ed. 90). An examination of the type, and a series of 22 ♂ and 10 ♀ before us taken by Dr. Klots in Little Tesuque Canyon, Sangre de Cristo Range 8000' vicinity of Santa Fe, N. M. (about 40 miles from the type locality) show sufficient differences from typical *atlantis* to warrant the retention of the name. The type of *beani*, kindly examined by Dr. A. E. Brower, is a very pale specimen and not typical of the usual run of specimens from Banff. In fact, the authors likened the upper and underside of the primaries to *lais* Edwards. They did not mention the upperside of the secondaries which may therefore be presumed to be similar to the primaries or give the sizes of the specimens.

The new sub-species is distinguished from *nickias* by the ground color of the upper side, the former being mars orange and the latter, yellow orange. The marginal band in *nickias* is not solid black and the limbal area of the secondaries has a light transparent appearance, the silver spots showing through. *Nickias* is also somewhat smaller, and on the underside, the submarginal band of the secondaries is broader and usually extends from the apex to the anal angle. The ♂ and ♀ are about the same color which is not the case in *canadensis*. The new sub-species is further distinguished from *beani* by its much larger size—the

largest *beani* before us being only 52 mm. The black markings on the upperside of *beani* are very much fainter, the marginal band is not solid, the ground color being similar to *nickias*. In every respect it is a more delicate insect.

Brenthis myrina terrae-novae Holland. 32 ♂ 11 ♀, June 23 to September 2.

It has been suggested that this name could be reduced to the synonymy of *atrocostalis* Huard. The series of both races before us (the latter mostly from Maine) lead us to believe that there is sufficient distinction to warrant the retention of this name. *Terrae-novae* was described from a series of ♂ from Newfoundland. We were only able to find the type and two paratypes in the Holland collection. The labels do not show from what part of Newfoundland they came, but it was probably from the eastern part of the Island. The series before us contains some males as heavily marked as Dr. Holland's type, (Butterfly Book, rev'd ed. pl. LV, f. 13), but the majority, on the upper side, resemble *myrina* (Cram.) in marking although the ground color is more reddish. On the underside, the ground color, especially of the secondaries, is a mahogany, quite distinct from *myrina*.

***Phyciodes tharos arctica* n. ssp.**

♂ 30 mm. Primaries, upperside; similar to *tharos* Drury but the marginal band is black and broader. Secondaries, similar to primaries. Primaries, underside; similar to *tharos* but the black markings slightly more extended and the ground color zinc orange. Secondaries, similar to *tharos* but the ground color zinc orange, the design less distinct, the outer margin between raw sienna and antique brown, the heliotrope grey crescent scarcely visible.

♀ 30 mm. Similar to ♂ but the underside of the secondaries somewhat paler and the design, as in *tharos*, more prominent.

1 ♂ July 11.

This sub-species is similar to Edwards' figure 14 (Butt. N. Am. II pl. Phyciodes I, var. D), which represents a specimen taken in Labrador, but the ground color of the secondaries on the underside is darker. They are distinguished from *tharos* by that feature. In *tharos*, the ground color is naples yellow while in the new sub-species it is zinc orange.

A ♂ and ♀ in the collection of the American Museum of Natural History taken by Mr. G. C. Hall in Newfoundland at Table Mountain, Port au Port, on July 29, 1922, and at Crabbes on July 26, 1922, respectively, are designated the holotype ♂ and allotype ♀. A ♂ in the Canadian National collection taken by D. Jeness July 20, 1927, road between Springdale and Davis Pond, Newfoundland, is designated a paratype. A ♂ and ♀ in the collection of the Carnegie Museum taken by Dr. Brooks in Newfoundland at Lomond, Camp 31, four miles south of Bonne Bay, west coast on July 21, 1934, and at Stoney Brook, other side of Exploit River, July 15, 1934, respectively, are designated paratypes ♂ and ♀. Paratype ♂, July 11, 1934, Doyle's Station, Newfoundland, in the author's collection. Another ♂ taken by Mr. Hall at Crabbes, Newfoundland, on July 26, 1922, is designated a paratype and has been placed in the collection of the Los Angeles Museum.

Polygonia comma Harris. 2 ♂ 1 ♀, June 23 (hibernated). 1 ♂, August 23 (summer brood).

Polygonia faunus Edwards. 2♂ 2♀, June 18-23 (hibernated). 1♂, September 7. (summer brood).

Aglais milberti Godart. 7♂ 4♀, June 9 to August 3.

Aglais antiopa Linnaeus. 2♂, June 12 to August 3 (hibernated).

From the very worn appearance of the August specimen, it appears to be a hibernator, which somehow managed to live until that late date.

Vanessa atalanta Linnaeus. 11♂ 2♀, June 13 to July 28.

Vanessa cardui Linnaeus. 1♀, August 23.

Basilarchia arthemis Drury. 2♂, July 18 to July 20.

These are somewhat darker and smaller with a wider white band on both wings than specimens from New England.

Lycaenopsis pseudargiolus lucia Kirby. 4♂ 9♀, June 12 to July 18.

Lycaenopsis pseudargiolus f. marginata Edwards. 3♂ 1♀, June 12 to July 9.

Some of these specimens are so worn that they are not easily placed but we feel confident that both forms are represented.

Carterocephalus palaemon Pallas. 1♂, July 8.

Polites peckius Kirby. 19♂ 5♀, July 10 to July 27.

The American literature relative to the *Rhopalocera* of Newfoundland seems unusually scant. We have only come across a letter dated December 18, 1882, from W. H. Edwards to the editor of the Canadian Entomologist enclosing "Notes on Butterflies obtained at Carbonear Island, Newfoundland, 1832-1835" (Can. Ent. XV 43 and 44), notes on eight species and one variety by Gamble Geddes (Can. Ent. XVIII 204), a short list of four species by A. F. Winn (Can. Ent. XLV 24) and an "Introductory Note" by I. A. Bruton (Ent. News XLI 34) to Philip Henry Gosse's unpublished "Entomologia Terrae Novae," which was written in 1835. This work listed thirteen species. It was illustrated with hand painted figures, some of which were named; a few were re-named by W. H. Edwards in the above mentioned letter.

The following species, mentioned in this literature, were not represented in the collection:

Pieris napi acadica Edwards.

Colias pelidne Boisduval.

Ooenis chryxus calais Scudder.

Brenthis freija Thunberg.

Melitaea harrisi Scudder.

Aglais j-album Boisduval & Leconte.

Lycaena epixanthe amictus Scudder.

Lycaena helloides Boisduval or *L. helloides florus* Edwards.

Plebejus scudderii aster Edwards.

Plebejus aquilo Boisduval.

Glaucopsyche lygdamus couperi Grote.

Pyrgus centaureae Rambur.

Date of Mailing, May 4, 1935.

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